FIRE HISTORY FOR THE DOOLITTLE CREEK DRAINAGE

WISDOM DISTRICT

BEAVERHEAD NATIONAL FOREST

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INTRODUCTION

A field investigation of the Doolittle Creek drainage was conducted during the summer of 1992. The objective of this study was to develop a generalized fire history for vegetation types in Montana. The information will also provide site specific information for the Doolittle drainage.

STUDY SITES

Data was collected from the low to upper elevation sites in the Douglas-fir zone and the lower subalpine fir zone. Elevations ranged from 6420 to 7500 feet on a variety of slopes and aspects.

Eight sites were sampled in this analysis. Site 1 was in a low elevation Douglas-fir community which extended into a sagebrush-grass type in sections 32 and 33 T1S, R14W; Site 2 was a mixed Douglas-fir, lodgepole pine community in portions of section 33 T1S, R14W and section 4 T2S, R14W; Site 3 in section 8 T2S, R14W was similar in composition to Site 1; Site 4 was primarily a lodgepole pine community with scattered Douglas-fir in section 9 T2S, R14W; Site 5 represented an upper elevation Douglas-fir and lodgepole pine community in sections 10 and 15 T2S, R14W; Site 6 was primarily in a riparian zone located in section 3 T2S, R14W and consisted of lodgeople pine, Douglas-fir, spruce and subalpine fir; Site 7 in section 34 T1S, R14W was a north slope and had similar species as found in Site 6 and Site 8 was on a southwest slope in sections 33 and 34 T1S, R14W containing lower elevation lodgepole pine on moist exposures and Douglas-fir on drier sites.

METHODS

There were two primary types of information that were studied during the field investigation: fire scars within the study area and data on age structure of the stands. A series of ECODATA plots were located on various aspects and elevations to sample the variety of vegetation conditions. A search of the area was made to locate fire scarred trees. Where possible a wedge was removed from the tree showing the fire scar sequence. In cases where it was not safe to remove a wedge because of rot, lean or severity of the scar the tree was felled and a slice taken from the fire scar region. A chainsaw powered increment borer was used to collect cores from at least three trees in each age class on or adjacent to the ECODATA plot. All age cores and fire scar blocks were taken to the office, sanded and age counted under a binocular microscope. Fire scars were identified on the blocks and dated to the age counts. The actual date of a fire event may be subject to some uncertainty as a result of false or missing rings or rings masked by pitch or rot. Counts on dead trees or stumps are also dependent on identifying the year the tree died or was harvested. Aging a fire event from the origin of a stand has even more uncertainty. Not only must an estimate be made of the years taken to grow to the sampling height but also an estimate of the time delay after the fire until a new stand was established was required. For these reasons fire events based on fire scars may vary plus or minus two to three years while those based on stand age may vary

5 to 10 years. All estimates of fire return intervals are calculated from 1930 and earlier. It is assumed that after 1930 fire control effectiveness impacted the fire return cycle.

RESULTS

DRAINAGE LEVEL ANALYSIS

During the period between 1707 and 1932, 31 fires were recorded by fire scars or stand origin information. A fire return interval of about every 7.5 years is indicated for the Doolittle drainage. Regeneration appeared to occur in cycles. The period between 1900 and 1919 was above average as was the 1850 to 1879 period. While data is limited before 1800 regeneration peaks may have occurred between 1790 and 1799 and, 1710 to1719. A major gap appears in regeneration between 1800 and 1840 with only two trees sampled from that 40 year period. The fire scars follow a fairly uniform number from decade to decade however during the 1850 to 1880 period scars were significantly higher. This level of scaring could indicate more severe fires which resulted in the higher number of births during the same period. These results however may just be random effects of the sampling technique. The data is limited before 1770 and the impact of the introduction of the horse around 1740 and subsequent burning for forage production by Native Americans could not be assessed.

No fires were noted that impacted the entire drainage. Sampling covered about 6,000 acres which would suggest that at least for the period between 1707 and 1932 fires were not extensive or they burned in a very spotty nature. Four fires (16 percent) that impacted 5 of the 8 sample areas occurred about 1901, 1875, 1863 and 1740. Moderate fires (evidence on 3 or 4 of the 8 sites) occurred 15 times which represents just under 50 percent of the fires. The remaining 9 fires were noted on one or two sites which would suggest that about 29 percent of the fires were in the hundreds of acres or less size. These conclusions are estimate at best. There is strong evidence that not all fires resulted in a fire scar at each sample site even though the area may have burned. This was particularly true in the Douglas-fir communities. Both the 1901 and 1875 fires may have covered almost all of the study area based on the location of scars throughout the area.

The lodgepole pine stands sampled were either one or two aged. Commonly the older age class consisted of scattered residual Douglas-fir remaining from the previous stand. The Douglas-fir stands were typically either 2 or 3 aged. One stand contained at least 5 different age classes. A number of mixed stands were sampled which contained spruce, subalpine fir, lodgepole pine and Douglas-fir. These stands also contained from 1 to 3 age classes. The older age classes in these stands were also dominated by Douglas-fir which survived the fire event that established the younger age classes. The youngest age class was about 75 years of age while the oldest class was about 380 years. The oldest tree aged was 386 years. There were a number of very large trees particularly on the edge of the sagebrush-grassland that could not be aged because of their size. These trees could exceed the maximum age noted.

As shown in Table 1 the total number of fires in any time period remained constant with some variation in fire size by time period.

TABLE 1- NUMBER OF FIRES BY TIME PERIOD BY NUMBER OF SITES IMPACTED

TIME PERIOD	NUMBER OF SITES IMPACTED					
	1	2	3	4	5	TOTAL FIRES
1900-1940	3		2		1	6
1860-1899		3		1	2	6
1820-1859		1	5			6
1780-1819	1			2	2	5
1740-1779		3		1	1	5

STAND LEVEL ANALYSIS

SITE 1 – This sample is in a stringer of forest cover extending down into the foothills sagebrush-grassland. Stands are dominated by very large old Douglas-fir primarily on a Douglas-fir/pinegrass-pinegrass habitat type. The community was originally an open stands which has filled in with a younger age class. Since fire exclusion these stands have expanded into the sagebrush-grassland and stand density has increased dramatically. Stands varied in age from 125 to 300 plus years and from 2 to 5 age classes. The fire return interval between 1765 and 1932 was about 19 years. The last fire occurred in 1932 however a fire possibly occurred in 1936. There appeared to be regeneration associated with about half of the fires. The longest fire free period was about 40 years. Because of the original open nature of these stands and the light fuels, the fire interval represents a conservative estimate of the fire frequency. Old Douglas-fir trees do not scar readily and it is expected that some of the low heat grass fires did not leave any scars. The oldest tree sampled was 384 years of age however some of the largest trees could not be aged and stand age may approach 450 to 500 years.

SITE 2 – Site 2 represents a more continuous forest cover with some small inclusions of sagebrush-grass type. Stands were similar to Site 1 however small inclusions of pure lodgepole pine were common. Habitat types consisted of Douglas-fir/twinflower-dwarf whortleberry on the moist sites and Douglas-fir/pinegrass-pinegrass on the drier areas. Stand age varied from 125 to 300 years with some scattered large old Douglas-fir which could not be aged. The oldest tree sampled was 318 years. Lodgepole pine stands were even aged resulting from a stand replacement event while the Douglas-fir stands contained at least 2 age classes. The fire return interval between 1740 and 1932 averaged 14 years. The last event that resulted in regeneration occurred in about 1862 and is represented by a pure lodgepole pine stand. The last fire occurred about 1923 and was a light underburn. Regeneration was associated with about 65 percent of the fires and the longest fire free period was about 25 years.

SITE 3 – This site was very similar to Site 1 and consisted of a mixed aged Douglas-fir type. It also was occupied by a Douglas-fir/pinegrass-pinegrass habitat type. At least three age classes were present ranging from 90 to 280 years. The oldest tree sampled was 281 years. As noted above some large trees could not be aged because of their size. The fire return

interval between 1716 and 1932 averaged about 13 years. The longest fire free period was about 57 years. About 75 percent of the fires were underburns with no reproduction associated with them. The last fire occurred in 1923 and the last fire with reproduction was 1894.

SITE 4 – While topographically similar to Site 2 this site contained more lodgepole pine with only scattered Douglas-fir residual from past stands. Habitat types consisted of Douglas-fir/pinegrass-pinegrass and subalpine fir/pinegrass. The site was even aged or contained 2 age classes with scattered Douglas-fir commonly making up the second age class. Stand age varied from 75 to 230 years with the oldest tree aged being 232 years. The fire interval between 1707 and 1932 was about 32 years and generally severe enough to result in regeneration. The last fire may have occurred about 1916 and resulted in regeneration. The longest fire free period since 1707 was about 83 years.

SITE 5 – This area represent the highest elevation area studied in the drainage and the habitat type was subalpine fir/ twinflower-dwarf whortleberry. Stands varied from Douglas-fir with some lodgepole pine to subalpine fir-lodgepole pine stands. The lodgepole pine sites were even aged while at least 2 ages were present in the Douglas-fir sites. Stand age varied from about 90 years to 200 plus. The oldest tree sampled was about 215 years of age. The fire interval was about 32 years between 1773 and 1932 and they were severe enough to result in regeneration. The last fire occurred about 1903 and was a stand replacement burn for a portion of the area. The longest fire free period since 1777 may have been about 84 years.

SITE 6 – Site 6 is characterized by riparian and north slope communities on a subalpine fir/twinflower-dwarf whortleberry habitat type with inclusions of Douglas-fir/pinegrass-pinegrass on direr sites. Lodgepole pine is the dominant species with various mixtures of spruce, subalpine fir and Douglas-fir. Stands are typically even aged; however one stand contained a scattering of trees that survived the last major fire. Stand age varied from about 95 years to 210 years. The oldest tree sampled was about 338 years of age. The fire interval was about 34 years between 1726 and 1932 and normally resulted in regeneration indicating at least a partial burn severity. The longest fire free period may have been about 62 years.

SITE 7 – The site is found on a west to northwest aspect and contains a complex of ages and species mixes. Habitat types were similar to Site 6. One to three age classes were associated with the area. Lodgepole pine and Douglas-fir are the common trees along with subalpine fir and spruce on moister sites. Stand age varied from about 75 years to 145 years with the oldest tree measured at 335 years. Between 1779 and 1932 the fire return interval was about 12 years. Typically there was some regeneration associated with each burn. The longest fire free period was about 24 years.

SITE 8 - The area is found on a Douglas-fir/pinegrass-pinegrass habitat type on the lower portion of the drainage associated with inclusions of sagebrush-grass type. On drier sites stands are pure Douglas-fir with as many as four age classes indicating an underburn fire type. On the moister sites mixtures of Douglas-fir and lodgepole pine are more typical and are normally even aged. Stand age ranges from 80 years to 200 years. The oldest tree aged

was 305 years. During the period from 1789 to 1932 the fire return interval was about 18 years. Regeneration normally occurred with about half of the burns. The longest fire free period was about 57 years.

FIRE GROUPS

An evaluation of the fire cycle was conducted using the fire groups developed by Fisher et al (1983). The majority of the sites sampled were in Fire Group 6. A few examples of Fire Groups 7, 4 and 5 were also encountered. The fire return period for Group 6 averaged about 8 years for the drainage and about 32 years at the stand level. This compares to an east side average predicted by Fisher et al. of 42 years at the stand level. The longest fire free interval was about 58 years at the stand level.

Fire Group 7 was sampled in three areas. The data suggested a drainage level frequency of about 15 years and a stand return of 61 years. One stand was frequented by numerous light underburns and was similar to the drainage level frequency. The east side average is highly variable ranging from less than 100 years to 500 years. The sites sampled probably represent the lower and drier portion of the Fire Group resulting in the higher fire frequency.

Fire Group 4 and 5 had limited information and may not represent the averages for the type. Stand level frequencies were 41 years for Fire group 4 and 27 years for Fire Group 5.

CONCLUSIONS

1. The last fire of any consequence was about 1924.

2. Establishment of a new age class generally was associated with a more severe fire event and many of the underburns had little impact on stand structure.

3. Fires were typically underburns in the Douglas-fir type and on the gentler lodgepole pine types. Stand replacement fires appear to have been small or spotty with intervening areas of underburn.

4. Where lodgepole pine stands had an extended fire free period they could reach ages in excess of 200 years fairly commonly. They did not appear to be subject to mountain beetle mortality to the same degree as found in western Montana.

5. Douglas-fir stands commonly exceeded 300 years in age particularly along the interface with the sagebrush-grass communities.

6. Historically Douglas-fir stands were very open or a savanna type. No remnant of the savanna type remain and the remainder have a significant understory of young trees.

7. Many stands are multi-aged even in the lodgepole pne communities.

8. No fire event impacted all of the study area suggesting that fires were commonly less than 10,000 acres in size.

9. Major fire periods were 1740, 1772-4, 1803-4, 110-12, 1862-4, 1875-6, 1888-9, and 1900-3.

SUMMARY OF FIRE EVENTS – DOOLITTLE CREEK DRAINAGE
BEAVERHEAD NATIONAL FOREST

Fire Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site Burned
1932	X								1
1923/5		X				X			2,6
1916/22	B		X	B		B	B		3,4,6,7
1912/15	B							BX	8
1906/08		X						B	2
1900/3	BX		B		B	B	BX	X	1,5,6.7.8
1894/6		X	X					B	2,3
1888/91		X	X		X-			B	2,3,5,8
1875/86	BX		X	B	BX		BX		1,3,4,5,7
1871/74	B						BX	X	7,8
1869/70	B	B	X				BX		3,7
1862/68	BX	BX	X		B		BX	B	1,2,3,7,8
1856/61				B	X	B	BX	BX	5,7,8
1850/54	X	X				B	BX		1,2,7
1846/49				X			BX	X	4,7,8
1841/43			BX	X		B			3,4,6
1832/33		BX	X						2,3
1823/25		X	X				X		2,3,7
1820			X						3
1810/19	X	X	X				X		1,2,3,7
1803/4	X	X	X				X		1,2,3,7
1788/00			X	B		B	B	BX	3,4,8
1784/87	X	X	X			B			1,2,3
1779/82						B	BX		6,7
1772/74	X		X						1,3
1763/65	X	X							1,2
1755	B	B		BX					2,4
1740	B	X				X	B	B	1,2,6,7,8
1726	B					X			6
1716	B	B	BX				B		1,2,3
1707			B	X			B		3,4,7
1690	B	B					B		2,7
1687	B	B						B	1,8
1674	B	B							1,2
1657							B		7
1606	B					B			1,6

X = fire scar
B = birth date of stand or part of stand

DOOLITTLE CREEK DRAINAGE – BEAVERHEAD FOREST
FIRE SCARS AND BIRTH YEARS

	SITE								
YEAR	1	2	3	4	5	6	7	8	FIRE EVENT
1936	X?								
1932	X								FIRE
1925			X?						
1924		X							FIRE
1923						X			
1922	B								
1920						B			
1918							B		FIRE
1917			X						
1916			X	B					
1915								B	
1914	B								FIRE
1913	B								
1912								X	
1908								B	
1906		2X							FIRE
1903	B		B		3B		X		
1901	XB						B		FIRE
1900						B		X	
1896		X?						2B	
1894			2X					B	FIRE
1891					X-				
1889		X?							FIRE
1888			X					B	
1886							B		
1885							B		
1881				B					
1879					B				FIRE
1878			X						
1877							X		
1876	X?								
1875	B		X		X		B		
1874	B						X?B		
1872							XB		FIRE
1871							X	X	
1870							B		
1869	B	B	X				X		FIRE
1868					B				
1866							B		
1865	B								FIRE
1864							X		
1863		XB							
1862	3X	B	X					2B	

YEAR	1	2	3	4	5	6	7	8	FIRE EVENT
1861								B	
1859							X		
1858				B				X	FIRE
1857							B		
1856					X	B			
1854		X							
1852		X							FIRE
1851							XB		
1850	2X					B			
1849							B		
1848							X		FIRE
1847				X					
1846							B	X	
1844						B			
1843			B						FIRE
1841			X	X+/-					
1833		B	X						FIRE
1832		X							
1825		X	X						FIRE
1823							X?		
1820									FIRE
1817			X						
1814			X-						
1812		X							FIRE
1811	X								
1810							X		
1804	2X						X		
1803			X				X		FIRE
1800				B					
1797								B	
1795				B					FIRE
1791						B	B		
1790			X						
1788								X-	
1787						B			
1786		X-							FIRE
1785	2X								
1784			X						
1782						B			FIRE
1779							X		
1778					B				
1777					B-				
1776							B		FIRE
1774	X								
1772			X						

YEAR	1	2	3	4	5	6	7	8	FIRE EVENT
1771			X+/-						
1765	X								FIRE
1763		X							
1761	B								
1760				B					FIRE
1757		B							
1755				X?					
1754	B								
1749								B	
1748		X-							FIRE
1741							B		
1740						X			
1729	B								FIRE
1726						X			
1724	B								
1721		B							
1719			B						FIRE
1718			B						
1716			X						
1715							B		
1711			B						FIRE
1707				X					
1703		B							
1698	B								FIRE
1690							B		
1688		B							FIRE
1687	B							B	
1679	B								FIRE
1674	B	B							
1657							B		FIRE
1608	B								
1606						B			FIRE

X = Fire scar
B = Birth date of stand or part of stand
? = Potential fire
- = Fire could have occurred earlier
+/- Actual date uncertain because of sample condition

REFERENCES

Fisher, William C.; Clayton, B.D. 1983. Fire ecology of Montana Forest Habitat types east of the Continental Divide. USDA, Forest Service General Technical Report INT-141. Intermountain Forest and Range Experiment Station, Ogden, UT 83p.

Pfister, Robert D., Bernard L. Kovalchik, Stephen F. Arno, and Richard C. Presby 1977. Forest habitat types of Montana. USDA For. Serv. Gen. Tech. Rep. INT-34. Intermountain Forest & Range Experiment Station, Ogden, UT 174p.

APPENDIX A		DOOLITTLE VEGETATION DATA											
PLOT #	LOCATION	HABITAT TYPE	ELV	ASP	AGE	DOM TRE	TREES /AC	BASAL AREA	DBH	HT	PLANT COVER		
											SHRUB	GRAM	FORB
001	S28,T1S,R14W SITE 8	DF/pinegrass-pinegrass	7030	336	118	LP	490	170	9	60	20	30	0
002	S33,T1S,R14W SITE 2	DF/heartleaf arnica	6430	245	176	DF	140	100	25	80	1	3	0
003	S34,T1S,R14W SITE 8	AF/whortleberry - whortleberry	6680	298	136	LP	610	170	8	61	20	1	1
004	S16,T2S,R14W SITE 5	AF/twinflower – whortleberry	7240	269	113	AF	340	100	11	85	50	80	10
005	S10,T2S,R14W SITE 7	DF/pinegrass – wheatgrass	7220	217	85+	DF	80	80	22	84	20	50	1
006	S9,T2S,R14W SITE 4	AF/pinegrass	7120	273	122+	LP	680	170	7	62	10	20	1
007	S9,T2S,R14W SITE 4	DF/pinegrass – pinegrass	7080	206	88	LP	190	100	11	50	20	10	20
008	S9,T2S,R14W SITE 4	DF/pinegrass – pinegrass	7090	295	202	LP	260	110	11	72	20	20	10
009	S4,T2S,R14W SITE 6	AF/twinflower – whortleberry	7110	072	183	S	330	120	14	83	30	10	1
010	S3,T2S,R14W SITE 6	AF/twinflower – whortleberry	7070	319	134	LP	410	110	5	60	20	0	0
011	S3,T2S,R14W SITE 6	DF/pinegrass – pinegrass	6920	197	77	LP	220	110	9	64	20	50	0
012	S34,T1S,R14W SITE 7	DF/pinegrass-pinegrass	6700	265	215	DF	120	80	19	69	1	30	10
013	S34,T1S,R14W SITE 7	AF/twinflower – whortleberry	6560	309	125	S	280	70	12	66	50	10	10
014	S34,T1S,R14W SITE 7	AF/twinflower – whortleberry	6480	253	104	LP	280	120	12	83	30	3	10

PLOT #	LOCATION	HABITAT TYPE	ELV	ASP	AGE	DOM TRE	TREES /AC	BASAL AREA	DBH	HT	PLANT COVER		
											SHRUB	GRAM	FORB
015	S34,T1S,R14W SITE 7	AF/twinflower – Whortleberry	6420	309	120	LP	770	170	8	73	20	10	1
016	S8,T2S,R14W SITE 3	DF/pinegrass – pinegrass	7090	304	272	DF	200	80	18	88	1	3	0
017	S33,T1S,R14W SITE 2	DF/pinegrass – pinegrass	7460	009	289	DF	200	80	21	77	1	10	20
018	S32,T1S,R14W SITE 1	DF/pinegrass – pinegrass	6890	004	293	DF	140	160	24	72	0	1	0
019	S32,T1S,R14W SITE 1	DF/pinegrass – pinegrass	7030	004	294	DF	140	110	19	76	3	60	40
020	S4,T2S,R14W SITE 2	DF/twinflower – pinegrass	7350	067	125	LP	440	120	10	62	30	30	3